Environmental rationale

River Murray shack wastewater management position statement

Purpose

This rationale document supports the Environment Protection Authority's (EPA) position statement on *River Murray shack wastewater management*.

Specifically, this rationale:

- describes the River Murray Water Protection Area (RMWPA) and its relationship to historic flood levels
- outlines the problems associated with septic systems[1] in shack settlement areas
- explains why septic systems pose a water quality risk along the River Murray
- documents how the EPA will respond to referrals within the RMWPA (including applications for wastewater holding tanks[2]).

Introduction

Protecting and improving River Murray water quality is important for all South Australians.

The River Murray and Lower Lakes are vital to South Australia's economy, communities and the environment[3]. The River Murray is the primary source of mains water supply to many cities and towns in the state. In 2013–14, 36% of SA Water-supplied raw water across South Australia was sourced from the River Murray[4]. Irrigated horticulture and river based tourism also rely on good water quality in the River Murray.

Threats to water quality are clearly evident during a flood or drought event. Less visible are the water quality threats from different land-uses and wastewater management practices within the River Murray basin at other times. The RMWPA

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1 Septic system means a system used on premises for the on-site collection, treatment and disposal of sewage generated at the premises and includes a septic tank

2 Holding tank means a tank or vessel used for the temporary containment of wastewater prior to approved disposal (*On-site Wastewater Systems Code,* SA Health 2013)

3 EPA 2013, *State of the Environment South Australia*

4 SA Water 2014, *Drinking Water Quality Report 2013–14*

declaration[5] recognises the significance of the River Murray to the state. Controlling land-use and adopting suitable wastewater management practices are key strategies in protecting the river from pollution.

Pollution sources along the River Murray and Lower Lakes, include:

- contaminated stormwater runoff
- river vessel grey water discharges
- drainage return from irrigation areas
- cumulative impacts associated with septic systems.

Typical pollutants from septic systems are nutrients (nitrogen and phosphorus), pathogens (eg *Cryptosporidium, faecal coliforms or E coli*), virus and protozoans (non-bacterial pathogens). High nutrient levels in the river leads to too much plant growth (often algae) which can impact the river system[6]. Algal toxins can also enter public water supply systems.

Elevated pathogen levels have been measured in the river and may present public health risks to recreational users of the river. Pathogens may also impact on drinking water supplies as a number of water treatment plant offtakes exists along the river.

While water quality impacts from a single septic systems may be small, the cumulative effect of many septic systems along the length of the River Murray is likely to be significant. As a consequence, the EPA seeks to avoid the intensification of landuse within the RMWPA, and for existing River Murray shack and residential developments to be connected to an approved community wastewater management system (CWMS).

River Murray Water Protection Area

The RMWPA covers the full 640-km length of the River Murray in South Australia. The RMWPA includes the River Murray floodplain, Lower Lakes and Coorong.

The RMWPA extends beyond (typically 500 m) the highest recorded flood event in the Murray valley which occurred in 1956. During this flood a peak daily flow of 341,000 mega litres[7] (ML) was recorded.

Limiting development within floodplains is an internationally recognised strategy for avoiding damage to property and communities during flood events. Development restrictions in flood zones also reduce the risk of debris and pollutants entering the water, which importantly, contribute to achievement of water quality objectives.

Historic flood levels have long been used as a ‘line in the sand’ beyond which development is restricted. Smaller more frequent flood events also impact on the water quality of the River Murray.

The likelihood of a flood event is often referred to as an average recurrence interval (ARI). For example, a 10-year ARI occurs on average once every 10 years. Annual exceedance probability (AEP)[8] is now the preferred term. The AEP expresses the likelihood of a flood of a particular size occurring in any given year. For example a 10-year ARI would have an AEP of 10%

5 As proclaimed under section 61A, Environment Protection Act 1993

6 EPA 2014, *Aquatic Ecosystem Condition Reports,* www.epa.sa.gov.au/data_and_publications/water_quality_monitoring/aquatic_ecosystem_monitoring_evaluation_and_reporting

7 Department of Environment, Water and Natural Resources 2015, *WaterConnec*t, https://www.waterconnect.sa.gov.au/Systems/RMIM/SitePages/Home.aspx

8 Accessed at WaterConnect on 6 July 2015, https://www.waterconnect.sa.gov.au

River Murray Inundation Mapping is currently available for two flow scenarios through WaterConnect — 60,000 ML/day and 90,000 ML/day flows as recorded at the South Australian border. A 90,000-ML/day flow was observed during February 2011. Many septic tanks, holding tanks and pump stations were under flood waters at this time. Before 2011, the last time a flow to SA equivalent to 90,000 ML/day was in December 1993, and prior to that in 1974 (180,000 ML/day flow).

A 90,000-ML/day flow has an AEP in the range of 10%, and is classified as a minor flood event for shack areas downstream of Cadell[8].

High flow advice is typically given when flows at the South Australian border exceed 40,000 ML/day.

In addition to the water quality risks posed by flood events, different landuses, land management and wastewater management practices along the RMWPA impact on river water quality.

Shack settlements and septic systems

River Murray shack settlements were largely established before the introduction of effective floodplain development control. More than 2,500 shacks are located along the length of the river and Lower Lakes in South Australia. Some shack settlements have more than 140 shacks, others have less than five, and in some cases a single shack. The Mid Murray Council area has the largest shack concentration in South Australia.

Shacks are located on both Crown and private land. During the 1990s the State Government offered the free holding of shack sites throughout the state subject to satisfying various criteria, including a wastewater management solution that was in accordance with SA Health requirements.

Installing a holding tank or connecting to a community wastewater management scheme (CMWS) became standard requirements as part of the free holding process on the River Murray flood plain.

Although some River Murray shack areas have a connection to a CWMS, many do not. Across the state, onsite wastewater systems frequently fail or have the potential to fail resulting in environmental pollution. Failures can occur for a number of reasons, including:

- poor (or no) maintenance
- undersized compared to hydraulic volume and pollution load
- age and deterioration
- installation standards
- reckless behaviour/abuse by owners (through such things as installing holes in holding tanks, pumping from holding tanks to land or river, and building over part/all of the storage and disposal system).

EPA staff have also observed evidence of failures and breaches of the former *Environment Protection (Water Quality) Policy 2003* (2015 version of this policy came into effect on 1 January 2016) with wastewater from holding tanks overflowing into the river.

The treatment and disposal of wastewater via a CWMS (or containment in a communal holding tank) and a suitable disposal scheme above the 1956 flood plain (and more than 100 metres from the normal pool level of the river) provides environmental benefits.

Many CWMS reuse wastewater and, in the process, create economic, social and environmental benefits. Sustainable reuse of wastewater is a key element in protecting water resources and reducing public health risks.

Water quality risks

To better understand water quality risks of the River Murray and Lower Lakes, the EPA released a significant risk assessment report in 2007[9].

Water quality risks were considered for the following environmental values[10]:

- aquatic ecosystem health
- raw water supply (suitability of water for supply to a drinking water treatment plant)
- recreational (including aesthetics).

Cumulative impacts from dwelling/shack septic systems, small townships, caravan parks and riverside public toilets were identified as a moderate risk to water quality.

A summary of the potential impacts (risks) to *environmental values* from such sources are outlined below.

Stressor	Environmental value		
	Aquatic ecosystem	**Raw water supply**	**Recreational use**
Nutrients (NU) eg phosphorus and nitrogen compounds	Contributes to algal growth/blooms that can lead to reduced dissolved oxygen levels and fish kill; ammonia can be toxic to biota	Contributes to algal growth/blooms which can cause taste and odour issues; nitrates may be toxic at high levels	Contributes to algal growth/bloom, which can be toxic and a skin irritant, and can affect visual clarity of the water
Pathogens (PA) eg *E coli, Giardia, Cryptosporidium*	Not applicable	Potential health implications	Potential health implications

The risk assessment also pointed to research which suggest that groundwater may be impacted when a threshold of septic system densities was exceeded.

Whilst an individual *septic systems* or *holding tank* might have a low risk of impacting River Murray water quality, the cumulative adverse water quality impact of hundreds of septic systems along a stretch of the river is likely to be significant. However, the EPA's 2007 risk assessment identified knowledge gaps in understanding the degree to which pathogens and nutrients were reaching the river and Lower Lakes.

Despite limited specific research on the fate and transport of nutrient and pathogen within the River Murray system, recent advances in microbial source tracking (MST) are improving our general understanding in this area. MST techniques use either microbial analysis of genetic material, or identification of bacterial characteristics to differentiate between human and animal sourced bacteria or viruses observed in the water sample[11]. MST is best described as a process of fingerprinting water samples to inform effective water resource management.

9 Mosley L and Billington K 2007, *The River Murray and Lower Lakes Catchment risk assessment project for water quality: Results and management options*, Environment Protection Authority, Adelaide.

10 Environmental values are anything a community agrees a body of water should be protected for (eg drinking water, agriculture, recreation).

11 US EPA 2005, *Microbial Source Tracking Guide Document.*

A range of source-tracking techniques have been applied in recent studies to source-identify faecal contamination. This is important because nutrients and pathogens are released into the river by a range of sources including agriculture, wild and domesticated animals, stormwater runoff and effluent treatment systems including septic systems.

Faecal indicator bacteria (FIB) such as faecal coliform, *Escherichi coli (E coli)* and *enterococci* have been used as indicators for pathogenic microorganisms[12]. FIB indicate a potential health risk but do not necessarily mean a health risk exists.

While detecting elevated nutrient levels and pathogens in the River Murray is relatively easy, accurately identifying the source and quantifying the relative pollutant contribution from different landuses is a challenge.

A recent study[13] used Antibiotic Resistance Patterns (uses resistance to antibiotics to generate a human specific fingerprint) for determining sources of feacal contamination, together with the location of sources, in a mixed landuse catchment in Southeast Queensland. All urban areas within the study area were serviced by *septic systems*. Findings of this study identified a higher percentage of human *E. coli* isolates (or human-specific fingerprints) in areas surrounding residential development relying on on-site systems (septic systems) for the disposal of wastewater. This study and others (including Carroll *et al* 2005[14], Ahmed *et al* 2008[12], Whitlock *et al* 2002[15]) observed a correlation between faecal contamination in a waterway and the surrounding landuses.

Similar correlations between on-site wastewater management, nutrient movement and nearby water quality have been observed through EPA applied research in the marine environment[16].

Despite gaps in our knowledge base on the fate and transport of nutrients and pathogens in the RMWPA, the EPA adopts a precautionary approach to the assessment of water quality risk.

The precautionary approach underpins the EPA's position.

EPA's role in the planning system

General obligations

River water quality is primarily regulated through the EP Act and the WQ Policy. A key objective of the WQ Policy is to protect the environmental values of a water body from pollution.

Water pollution refers to inputs of a chemical, waste or sediment into a water body that has the potential to cause an environmental impact and can be from a point source[17] or diffuse pollution[18].

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12 Ahmed W, Powell D, Goonetilleke A, Gardner T 2008, 'Detection and source identification of faecal pollution in non-sewered catchment be means of host-specific molecular markers', *Water Science & Technology*, 58(3):579–586.

13 Carroll SP, Dawes L, Hargreaves M, Goonetilleke A 2009,' Faecal pollution source identification in an urbanising catchment using antibiotic resistance profiling, discriminant analysis and partial least square regression', *Water Research* 43:1237–1246

14 Carroll S, Hargreaves M, Goonetilleke A 2005, 'Sourcing faecal pollution from onsite wastewater treatment systems in surface waters using antibiotic resistance analysis', *Journal of Applied Microbiology*, 99:471–482.

15 Whitlock JE, Jones DT, Harwood VJ, 2002, 'Identification of the sources of fecal coliforms in an urban watershed using antibiotic resistance analysis', *Water Research* 36: 4273–4282.

16 Gaylard S, Nelson M and Noble W 2013, *Nearshore Marine Aquatic Ecosystem Condition Reports: Lower Spencer Gulf Assessment Report 2010*, Environment Protection Authority, Adelaide.

17 Point source pollution: refers to the entry of pollutants from readily identified locations, such as a pipe or sewer outflow. Industrial factories, sewage treatment plants, and stormwater outflow pipes are common point sources of water pollution.

The discharge or deposit of sewage or waste from a septic system into any waters of the River Murray, including onto land where it might enter groundwater or move through the soil to the river, is an offence under the WQ Policy.

The EPA uses a range of legislative and non-legislative tools, including education campaigns, to minimise the entry of pollutants into the River Murray.

Development Plan Amendments

At the Development Plan Amendment stage the EPA will have an interest in proposed changes to planning policy or rezoning of land within the RMWPA. The EPA will be particularly interested in any policy change that could lead to an intensification of landuse and associated threats to water quality.

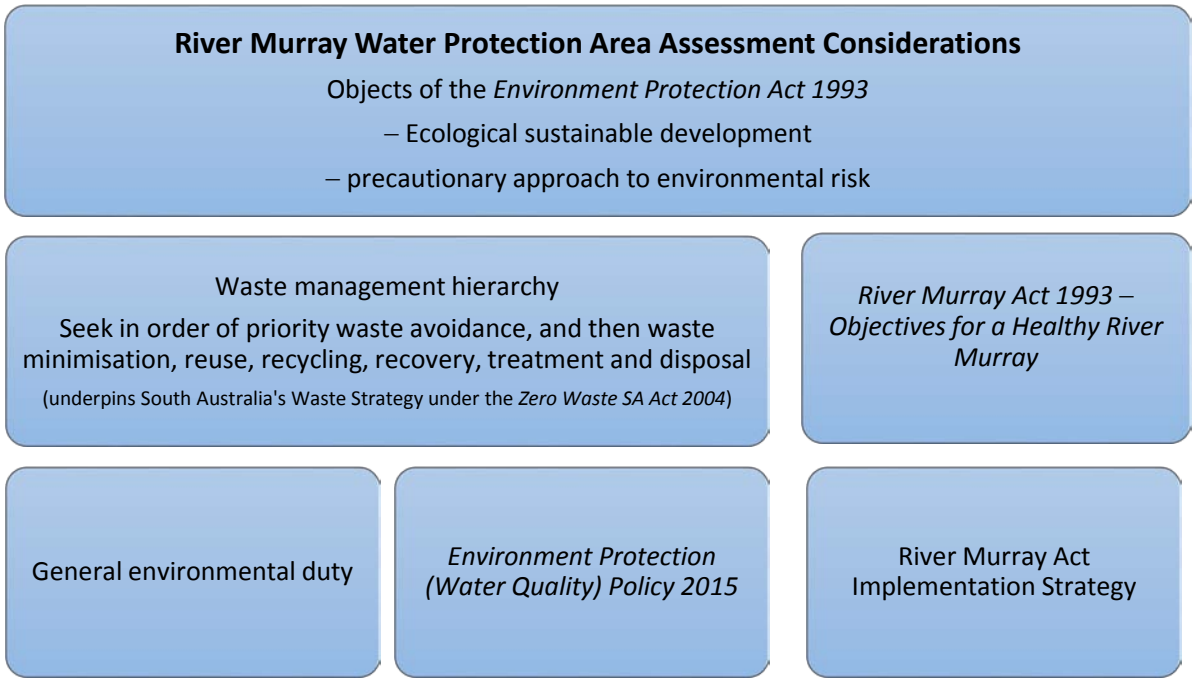
Development applications

Non-complying development applications within the RMWPA must be referred to the EPA. The EPA may exercise its power to *direct* refusal of such applications, or *direct* the planning authority to impose conditions on any approval.

EPA assessment of referred developments applications is governed by section 57 of the EP Act. In undertaking an assessment the EPA must have regard to, and seek to further, the objects of the EP Act and have regard to the general environmental duty, any relevant environment protection policies and the waste strategy for the state adopted under the *Zero Waste SA Act 2004*.

Water protection areas declared under the EP Act are considered particularly sensitive environments. When assessing referred development applications within the RMWPA the EPA must (refer section 10A of the EP Act) have regard to the *Objectives for a Healthy River Murray* under the *River Murray Act 2003* (insofar as they may be relevant).

EPA assessment considerations within the River Murray Water Protection Area are outlined in the following diagram.



[18] Diffuse pollution: refers to non-point source pollutants that run off or seep into waterways from broad areas of land such as agriculture or urban settings, as well as dispersal from airborne pollutant sources. Major forms of diffuse pollution include seepage from septic tanks, sediment run-off from construction sites, and pesticides and fertilisers from agricultural operations. Non-point sources are generally the largest contributors to water pollution at the catchment scale.

Wastewater holding tank referrals

The *On-site Wastewater Systems Code* (April 2013) is a prescribed code for the purposes of the South Australian *Public Health Act 2011* and the *Public Health (Wastewater) Regulations 2013*. The code applies to the design, approval, installation and operation of on-site wastewater systems up to certain capacities specified.

Section 10.2.2 of the code states:

> Holding tanks are not permitted for existing allotments in **Water Protection Areas** as proclaimed under Section 61A of the Environment Protection Act 1993 without written approval from the Department of Health and Aging (DHA) and the Environment Protection Authority (EPA).

EPA assessment of referred wastewater holding tanks application under the code is governed by the objects of the EP Act the general environmental duty and the WQ Policy. Therefore, the EPA has regard to the same assessment considerations as it would for a non-complying development within the RMWPA.

EPA's position

The EPA takes a precautionary approach to assessing water quality risks arising from River Murray shack/residential development and associated wastewater management.

EPA position	Rationale
In relation to Development Plan Amendments, the EPA will seek to avoid further intensification of landuse within the River Murray Water Protection Area (such as the creation of addition shack settlement policy areas, rural living zones or similar planning policy) which could lead to increased threats to river water quality	The RMWPA declaration, under the EP Act, recognises the significance of the River Murray to the state. Controlling landuse and adopting suitable wastewater management practices are key strategies in protecting the river from pollution. Limiting development within floodplains is a key strategy for avoiding damage to property and communities during flood events. Development restrictions in flood zones also reduce the risk of debris and pollutants entering the water, which importantly, contribute to achievement of water quality objectives. Threats to water quality are clearly evident during a flood or drought event. Less visible are the water quality threats from different landuses and wastewater management practices within the River Murray basin. While an individual septic systems or holding tank might have a low risk of impacting River Murray water quality, the cumulative adverse water quality impact of hundreds of septic systems along a stretch of the river is likely to be significant. Research findings have observed a correlation between faecal contamination in a waterway and the surrounding landuses, with some studies identifying a higher percentage of human-specific pollutants in water areas surrounding residential development relying on on-site systems (septic systems) for the disposal of wastewater.

EPA position	Rationale
In relation to non-complying development application referrals, the EPA: • will apply the *waste management hierarchy** to referred development applications, to avoid on-site containment or disposal of wastewater in preference for a communal wastewater scheme *In order of priority: waste avoidance, and then waste minimisation, reuse, recycling, recovery, treatment and disposal	The waste management hierarchy is recognised internationally as an aspirational framework for sustainability and underpins South Australia's Waste Strategy 2015–2020 (adopted under the *Zero Waste SA Act 2004*). The waste management hierarchy is a fundamental consideration in the assessment of referred development applications under section 57 of the EP Act. In addition, the WQ Policy imposes a general obligation on persons to apply the waste management hierarchy in taking all reasonable and practicable measures to prevent or minimise environmental harm from an activity that might pollute waters. In order to meet the general environmental duty applicants would need to demonstrate the waste management hierarchy had been applied to their development to avoid the potential discharge of pollutants.
• will consider the exposure of the development site to various river flow scenarios in determining the risk of likely flood inundation and associated water quality risks	Human wastewater, debris and other pollutants are typically released into the river when a shack site is inundated during a flood event. Therefore, the likelihood, or frequency, of a flood event is an important factor in a water quality risk assessment. Publically available River Murray flood mapping will be used as a guide only to inform whether a more detailed flood risk assessment might be required.
• considers sites that might be inundated by a 90,000-ML/day flow (when measured at the SA border) as a high flood risk	A 90,000-ML/day flow has an annual exceedance probability in the range of 10% (or a 1-in-10 year return flood event) and is classified as a minor flood event for shack areas downstream of Cadell. A flood of this magnitude has the capacity to cause serious environmental harm to river water quality every ten years or more often. Having regard to the EPA environmental harm risk matrix, this represents a high risk warranting EPA scrutiny. A 90,000-ML/day flow was observed during February 2011. Many septic tanks, holding tanks and pump stations were under flood waters at this time. Publically available River Murray flood mapping will be used as a guide only to inform whether a more detailed flood risk assessment might be required.

EPA position	Rationale
• will consider available reports[19] examining barriers to establishing wastewater connections to wastewater treatments plants or community wastewater management schemes in particular shack/residential settlement areas when assessing referred development applications	Having regard to legitimate barriers to constructing a communal wastewater management system in a particular shack settlement area forms part of EPA's consideration of what is reasonable and practicable. Under the EP Act (section 25) and the WQ Policy (cl 9) a person must not undertake an activity that might pollute the environment unless that person takes reasonable and practical measures to prevent of minimise harm from that activity. For many shack owners connecting to an operational community wastewater management system (CWMS, or similar communal scheme) will be achievable and reasonable. In determining whether legitimate barriers to establishing or connecting to a CWMS exist, the EPA will generally place greater weight on a report commissioned by a council, as opposed to an individual. Typically, such a report would need to examine a range of water quality risks, and practical, strategic and financial implications associated with establishing a CWMS in a particular shack settlement area(s).
• advises that where a communal wastewater scheme is impractical, the applicant must demonstrate how the proposed development would have a *neutral* or *beneficial effect* on River Murray water quality: – *neutral effect* (may be acceptable) – no change in water quality risks – *beneficial effect* (preferable) – contributes directly to improving water quality	The EPA will apply the *neutral or beneficial test* in determining the overall risk to water quality from the proposed development. Water quality risk factors forming part of the EPA's consideration include: • proximity of the site to the River Murray pool level and any backwaters or creeks connected to the main river • slope of the site, and • whether the proposed development will intensify the use of the land, including potential increases in wastewater generation as a result of new building extensions or replacement
In relation to wastewater holding tank referrals, the EPA: • will not support a wastewater holding tank application in areas that are currently serviced by a Community Wastewater Management System (CWMS) as these proposals are not consistent with the *waste management hierarchy*	Across the state, on-site wastewater systems frequently fail or have the potential to fail resulting in environmental pollution. Failures can occur for a number of reasons, including: • poor (or no) maintenance • undersized compared to hydraulic volume and

19 Such as Outhred J 2014, *Options paper into wastewater management for River Murray shack site areas with no community wastewater management system*, Adelaide

EPA position	Rationale
	pollution load • age and deterioration • installation standards • reckless behaviour/abuse by owners (through such things as installing holes in holding tanks, pumping from holding tanks to land or river and building over part/all of the storage and disposal system). EPA staff have also observed evidence of failures and breaches of the WQ Policy with wastewater from holding tanks overflowing into the river. The treatment and disposal of wastewater via a CWMS (or containment in a communal holding tank) and a suitable disposal scheme above the 1956 flood plain (and more than 100 metres from the normal pool level of the river) provides environmental benefits. Many CWMS reuse wastewater and, in the process, create economic, social and environmental benefits. Sustainable reuse of wastewater is a key element in protecting water resources and reducing public health risks consistent with the *waste management hierarchy*.
• will assess the suitability of a wastewater holding tank for existing dwellings/shacks in the following circumstances: – communal wastewater management is not a viable solution, and – it represents an upgrade to an existing on-site wastewater disposal system in terms of water quality risks (eg replacing failing subsurface soakage system draining into the River Murray with a holding tank with off-site tankering and disposal); and/or – it was a temporary wastewater management strategy pending the construction of a CWMS to service the area; and/or – there was a high likelihood that the council would approve of a proposed dwelling on the site based on the current development plan provisions (dwellings are considered on their 'merits').	Having regard to legitimate barriers to constructing a communal wastewater management system in a particular shack settlement area forms part of the EPA's consideration of what is reasonable and practicable. Where communal wastewater management is not viable, the EPA will compare the water quality risks of a holding tank against the risks associated with the current wastewater disposal system. Under the EP Act (section 25) and the WQ Policy (clause 9) a person must not undertake an activity that might pollute the environment unless that person takes reasonable and practical measures to prevent of minimise harm from that activity. Outlining a temporary strategy pending the construction of a CWMS, and having regard to the current development plan provisions on dwelling permissibility, are relevant considerations in determining what might be reasonable and practicable in the circumstances.
• will not support a wastewater holding tank for sites likely to be inundated by a 90,000-ML/day flow or less (when measured at the SA border)	A 90,000 ML/day flow has an annual exceedance probability in the range of 10% (or a 1-in-10 year return flood event) and is classified as a minor flood event for shack areas downstream of Cadell. The EPA's position is consistent with the *Design, installation and performance requirements* for holding

EPA position	Rationale
	tanks on existing allotments detailed in section 10.2.2 of the *On-site Wastewater Systems Code (*SA Health, April 2013).